



EPA Coalbed Methane Outreach Program Technical Options Series
COAL MINE METHANE USE IN BRINE WATER TREATMENT



Coal Mine Methane-Fueled Evaporator at Morcinek Mine, Poland
(Photo Courtesy of Aquatech Services, Incorporated)

AN INTEGRATED APPROACH TO DISPOSAL OF PRODUCED BRINES

- ◆ Wastewater treatment process uses coal mine methane as fuel
- ◆ Can be an economically viable alternative to other water management methods
- ◆ Appropriate for coal mines and coalbed methane fields producing large volumes of saline water
- ◆ Produces fresh water suitable for domestic, industry, or agriculture usage
- ◆ Can use medium quality gas (as low as 50 percent methane)

The use of coal mine methane enhances brine water treatment economics while reducing emissions of methane to the atmosphere

Why Consider Coal Mine Methane Use in Brine Treatment?

Coal mines and coalbed methane wells often generate large volumes of water, which may be highly contaminated with salt and other minerals. Because these brines can alter water quality, they must be disposed of in compliance with national and local statutes. Energy producers are continually seeking to improve economics by decreasing water management costs.

Many coal mines drain methane from gob areas (collapsed rock over mined-out areas). Mine ventilation air contaminates gob gas, often rendering it unsuitable for pipeline injection. Therefore, mines usually vent this gas to the atmosphere instead of using it. By using this gas as a fuel in the brine water treatment process, coal mines can reduce the cost of desalination while helping to mitigate greenhouse gas emissions.

Desalination plants typically have large fuel requirements, and coal mine methane is a clean, low-cost fuel

Over the last three years, the use of coal mine methane in brine water desalination has been successfully demonstrated at the Morcinek coal mine in Poland's Upper Silesian Coal Basin. The process, designed by Aquatech Services, Incorporated, integrates pre-treatment regimes, high-pressure reverse osmosis, and a final concentration of the salt in a submerged combustion evaporator. The pretreatment regime is specially designed for the complex waste streams typical of coalbed brines. Following pretreatment, a reverse osmosis system converts the brine wastewater to usable fresh water and a brine-salt slurry. Evaporation units, fired by medium-quality gas recovered from the Morcinek Mine, further concentrate the residual slurry to dry salts for commercial use or underground disposal.

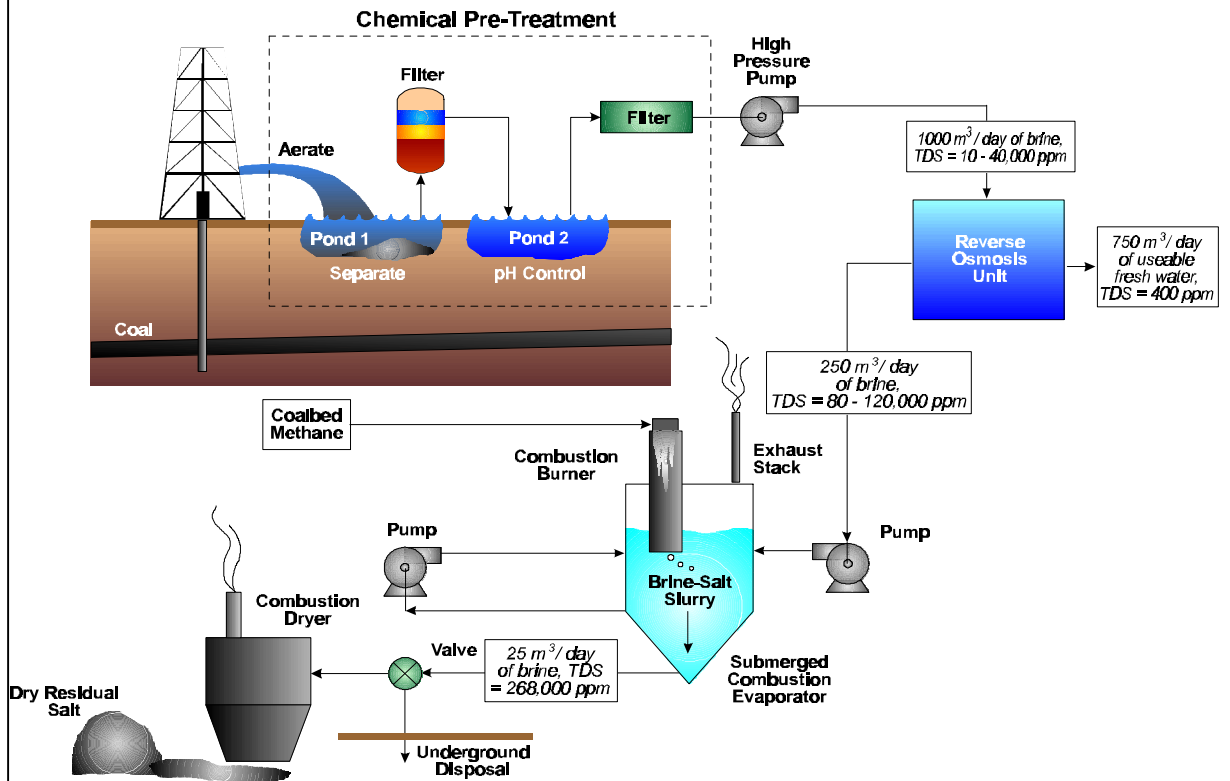
The demonstration project at the Morcinek Mine is treating more than 50 cubic meters (314 barrels) of waste water per day. Testing of the demonstration equipment began in 1994, with support from the U.S. Department of Energy, U.S. Environmental Protection Agency, and Polish government. All results have been positive, demonstrating efficiencies greater than anticipated, and validating and confirming process reliability.

Some Facts About Using Coal Mine Methane for Waste Water Treatment (based on results of the demonstration project at the Morcinek Mine)

- Treatment costs are competitive with those of underground injection
- Modular design allows for wide range of effluent volumes
- Process can recover more than 60% of the feed stream as usable fresh water, suitable for domestic uses in many cases
- Process offers total brine volume reductions of greater than 95%
- Suitable for coalbed methane wells in unmined areas, as well as coal mining operations
- Can use medium quality gas (as low as 50% methane)

Desalination processes (unlike underground injection) can produce fresh water for crop irrigation, domestic, and industry use

Example of Aquatech Wastewater Treatment Process



Comparison of Aquatech Process (Using Coal Mine Methane as Combustion Fuel) to Underground Injection

| Parameter | Reverse Osmosis Followed by Combustion Evaporation (Aquatech) | Underground Injection Only ⁽¹⁾ |
|---------------------------------------|---|--|
| Typical capital costs (\$US) | \$3,000 per m ³ /day \$480 per bbl/day | \$1,260 - \$5,660 per m ³ /day \$200 - \$900 per bbl/day |
| Typical operating costs (\$US) | \$2.00 - \$3.00/m ³ ⁽²⁾ \$0.32-\$0.47/barrel | \$0.60- \$4.70/m ³ \$0.10-\$0.75/barrel |
| Conversion to usable water | YES | No |
| Production of usable salts | YES (in some cases) | No |
| Uses coal mine methane ⁽³⁾ | YES | No |
| Total brine volume reduction | >95% | 0% |
| Life of plant or well (years) | 10 | 20 |

⁽¹⁾Underground injection costs and well life vary widely according to site-specific conditions. Costs shown are from 1995 assessment of water disposal practices in the U.S., published by the Gas Research Institute (GRI), and from an unpublished report on disposal of produced waters in the San Juan Basin prepared in 1992 for GRI. Costs shown do not include off-site transportation. Twenty years is the average injection well life according to Warner and Lehr, 1977, An Introduction to the Technology of Subsurface Wastewater Injection: A symposium in Worthington, Ohio.

⁽²⁾On a lease-purchase basis

⁽³⁾Coalbed methane can be an economical fuel source for treatment of water produced from coal mining operations or coalbed methane wells. Use of methane produced during coal mining operations is especially attractive in that in most cases, this methane would otherwise be vented to the atmosphere. This "waste gas" is a valuable fuel source if mines use it, otherwise, it is a potent greenhouse gas that causes global warming.

For More Information...

Energy producers are continually seeking to improve economics by decreasing water management costs. Coal mine methane used as fuel for a wastewater treatment process is an economic means of wastewater management that can also reduce emissions of methane to the atmosphere.

EPA is aware of only one company (Aquatech Services, Incorporated) whose brine water treatment process has employed coal mine methane as a fuel.* To obtain more information about this process, contact:

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Coalbed Methane Outreach Program

Or contact EPA's Coalbed Methane Outreach Program for information about this and other profitable uses for coal mine methane:

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*The mention of products or services in this case study does not constitute an endorsement by EPA.